

# **Fast-Response Isotopic Air Monitor**

**(DE-AR26-98FT40365)**

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The logo for ThermoPower, featuring the word "Thermo" in a standard font and "Power" in a bold, italicized font, both in a dark blue color. The logo is positioned on the right side of a thick blue horizontal bar that spans the width of the slide.

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**Deactivation and Decommissioning Focus Area**

**FY1999 Mid-Year Review Meeting**

**U.S. Department of Energy**

**Federal Energy Technology Center**

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# Need Statements

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- ◆ **Critical Needs Exist for Instruments to Monitor Low Level Radioactivity in**
  - Workplace Breathing Environments
  - Thermal Treatment System Off-Gas
  - Effluent and Process Water
- ◆ **Must Rapidly Identify Very Low Levels of Alpha-Emitting Radionuclides**

# Water Alpha Monitor System

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# Water Monitor Concept

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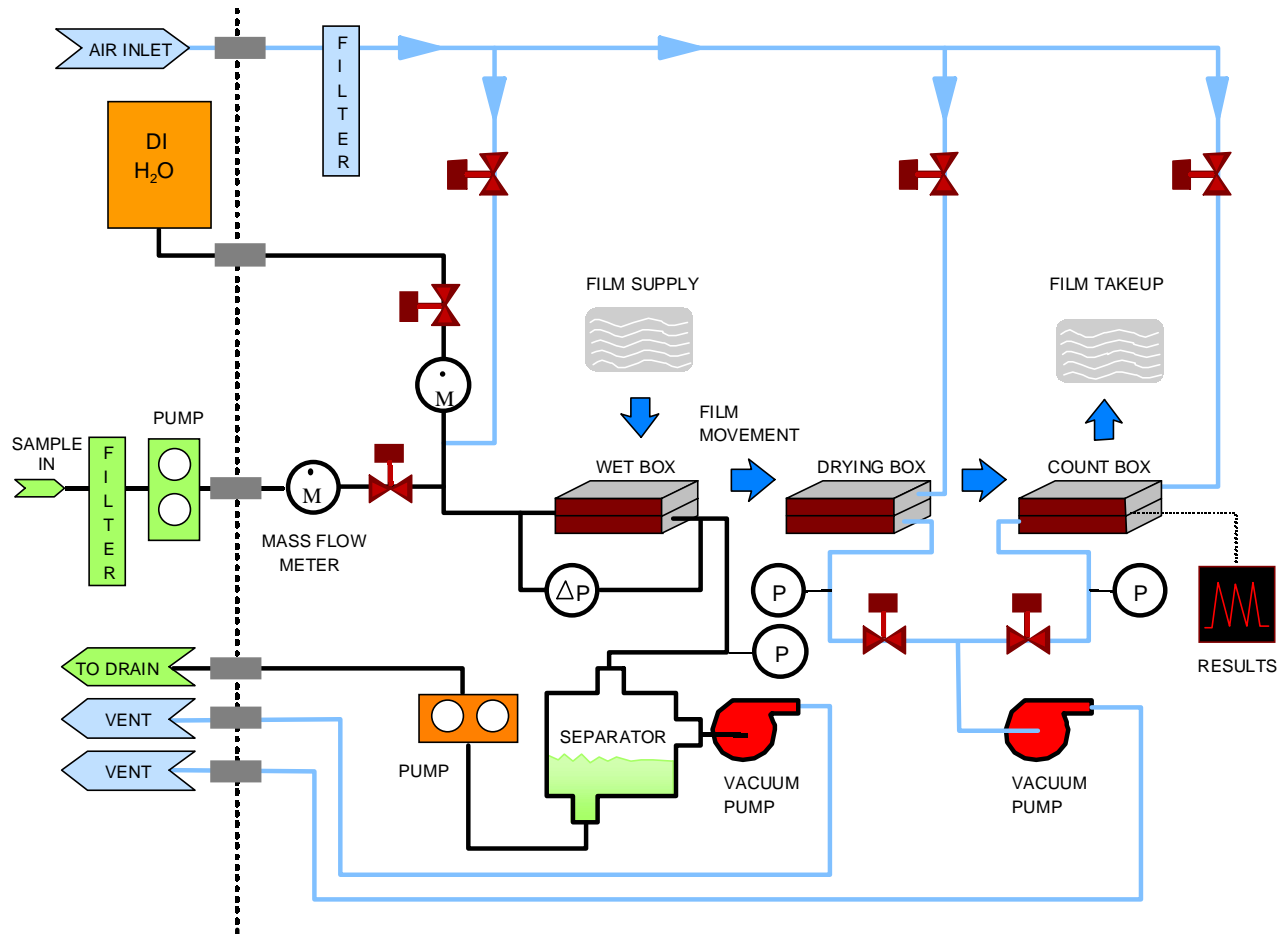
ThermoPower

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- ◆ **Collect Radionuclides from Liquid Stream on Surface of Proprietary Film**
- ◆ **Analyze Film Using Large Area Solid State Detector**
- ◆ **Automated Instrument Automatically Provides Analysis Results**
- ◆ **Archive Film per Data Quality Objectives**

# Thermo Alpha Monitor Schematic

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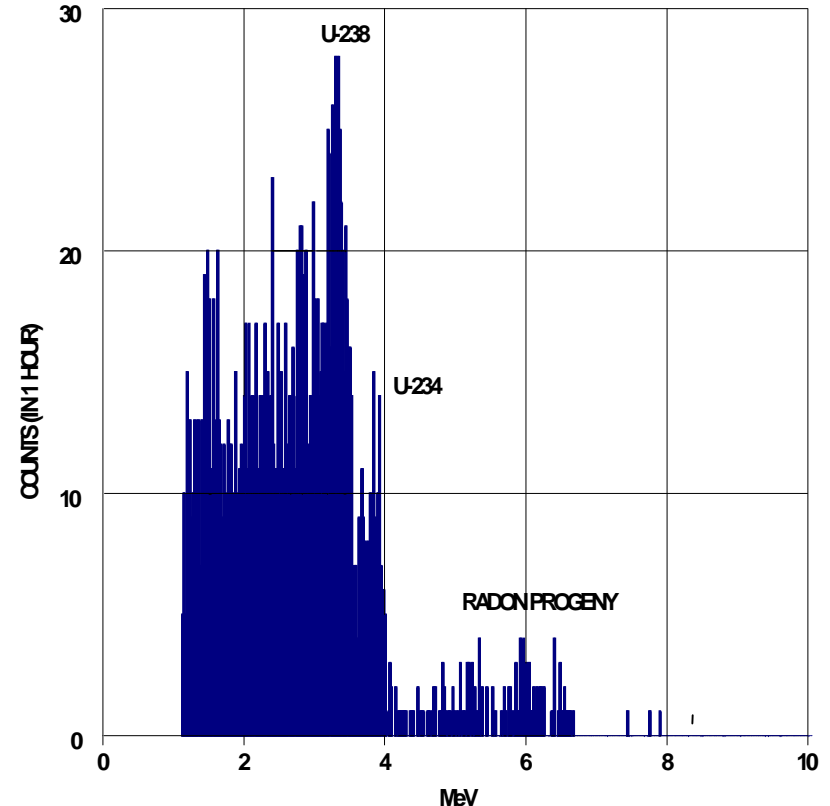
# Rapid Analysis Results From Oak Ridge Field Test

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Thermo Alpha Monitor for Liquids Field Test  
Installed at DOE Oak Ridge Y-12 Bear Creek Valley



Thermo Alpha Monitor for Liquids Results  
Surface Water at DOE Oak Ridge (BCV SS-5)



# Water Monitor Project Status

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- ◆ **Successful Field Test Oct. '98**
- ◆ **Final Report Submitted**
- ◆ **Negotiating Extended Duration Field Tests at**
  - Oak Ridge Y-12 Plant - Bear Creek Valley Site
  - LANL Radioactive Liquid Waste Treatment Facility

# Future Manufacturing Plans

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## ◆ Issue:

- Need to Reduce Instrument Complexity and Cost to Provide Financial Payback

## ◆ Approach:

- Build Separate Sample and Analysis Modules

## ◆ Rationale:

- Most Sites Prefer Semi-Automatic Operation with Lower Cost Instrument

# New Alpha-CAM System

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# Project Goals

ThermoPower

- ◆ **Meet DOE's Critical Instrumentation Need for**
  - Improved Alpha Continuous Air Monitoring (CAM)
  - Using Technology that Applies Towards Alpha Continuous Emissions Monitoring (CEM)
- ◆ **These Needs Identified by DOE's D&D, Mixed Waste, and Plutonium Focus Areas**
- ◆ **The CAM Instrument Should Provide:**
  - Improved Operation in Areas With High Radon Background Levels
  - Low Pressure Drop, Low Power Consumption, Low Noise Levels

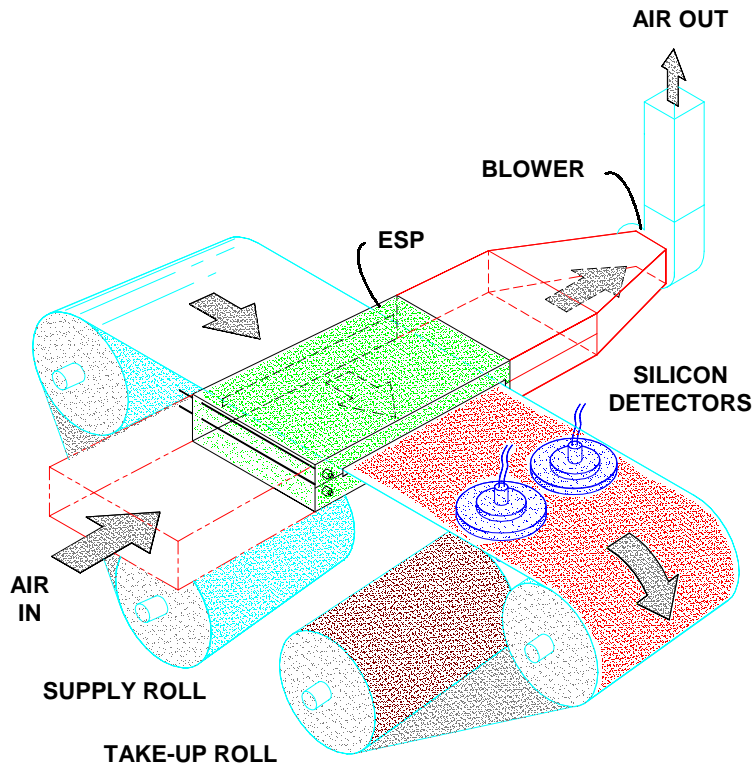
# Technical Approach: Air Monitor Concept

ThermoPower

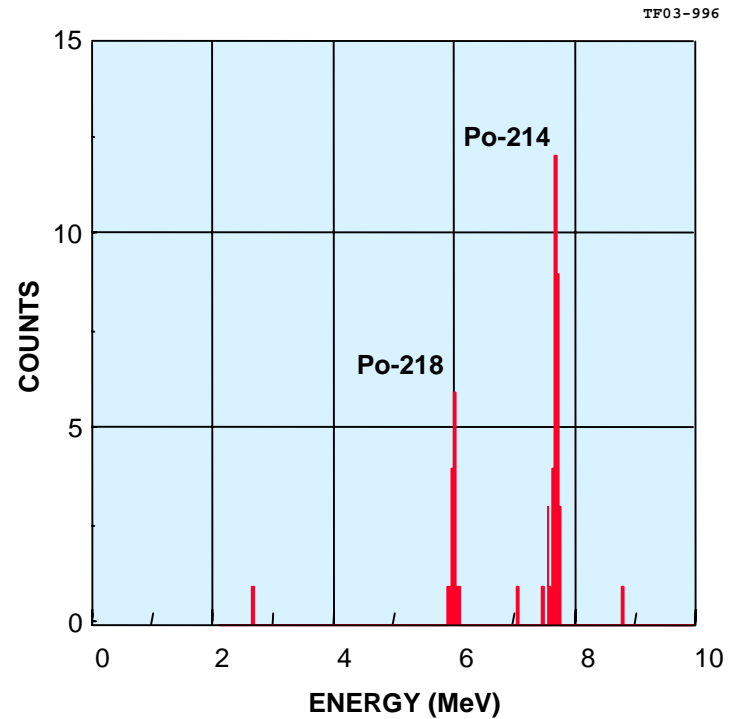
- ◆ **Evolved From Water Monitoring Concept**
- ◆ **Collect Radionuclides from Air/Gas Stream**
  - Using Electrostatic Precipitation
  - On Smooth-Surfaced Film
- ◆ **Automatically Analyze Film Using Large Area Solid State Detector**
- ◆ **Archive Film per Data Quality Objectives**
- ◆ **This Technology Can Be Used For**
  - Air or Flue Gas
  - Particulate Solids Preconcentration for Analysis by Conventional Methods (I.E. XRF, LIF, PSD, Etc.)

# Air Monitor Description

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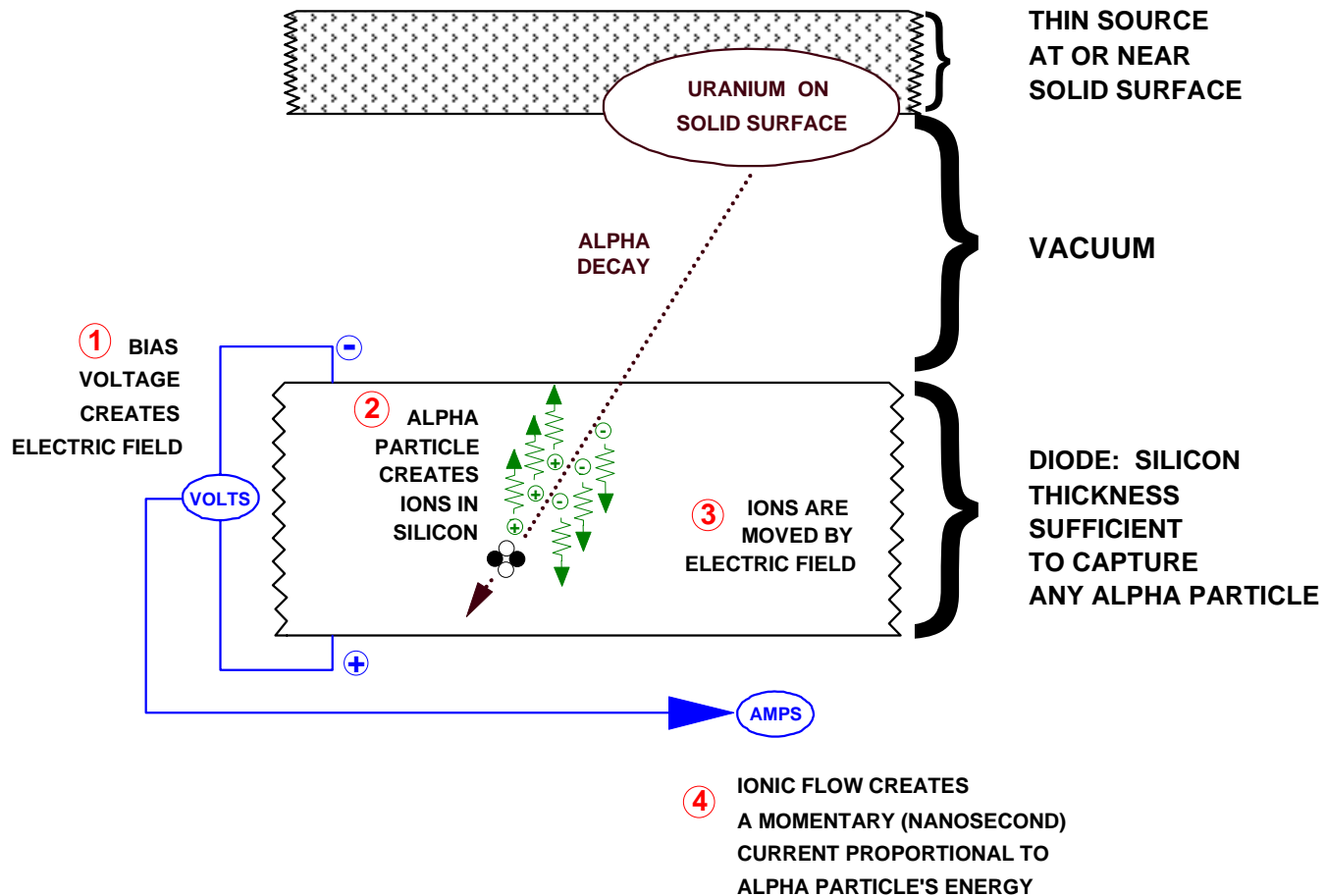


Spectrum from New ESP CAM



# Silicon Diode Measurement Concept

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# Scope of Work

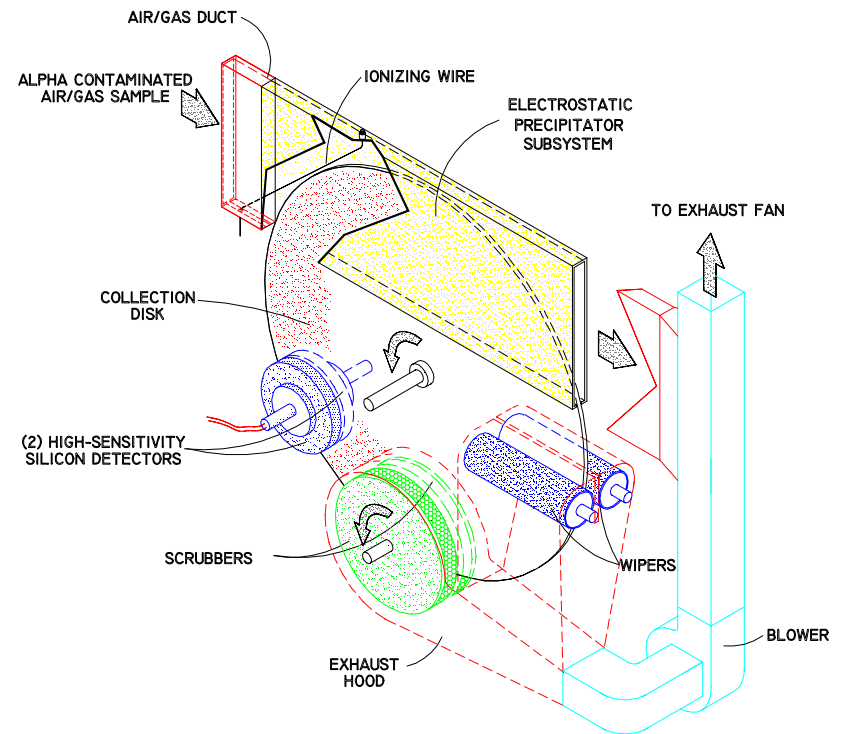
- ◆ **Phase I: Build and Laboratory Test a Prototype Rapid CAM System**
- ◆ **Phase II:**
  - Build and Perform Independent Lab Test of a CAM at Lovelace Respiratory Research Institute
  - Build and Field Test a CAM at a D&D LSDDP
- ◆ **Deploy CAMs to Meet DOE's Need**

# Maturity of the Technology

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- ◆ Demonstrated in the Laboratory
- ◆ Gate/Stage Status: Stage 4 - Advanced Development

## LAB DEMONSTRATION UNIT



# Relevancy: Current DOE Needs

ThermoPower

- ◆ **Improved Air Alpha Monitoring: 12<sup>th</sup> of 31 D&D Needs**
- ◆ **5 Primary STCG Needs:**
  - Radiological Air Monitoring Needs for Current D&D / ER Operations (AL-09-01-02-DD-S)
  - Improved Worker Protection Equipment (CH-DD04-99)
  - Real-Time Personnel Monitor for Alpha Contamination (OH-F002)
  - Enhanced Sensitivity Radon Meter (OH-F035)
  - Improved High Volume Air Sampler Capable of Fractionation of Airborne Particles (OH-F034)
- ◆ **9 Related STCG Needs (Flue Gas, Beryllium, Etc.)**

# **Timeliness of Program: Large DOE Market Potential**

**ThermoPower**

- ◆ **Many Continuous Air Monitors Needed in Coming Years Across DOE Complex**
- ◆ **Approximately 500 New CAMs (Minimum)**
  - LANL: 250 - 300 New CAMs
  - WIPP: 7 - 10 New CAMs
  - Hanford - 150 New CAMs
  - SRS - 50 New CAMS

# Performance Advantages Compared to Baseline Technology: Filter-Based CAMs

ThermoPower

- ◆ **First of a Kind Instrument Uses No Filters**
  - Improved Isotopic Resolution
  - Provides Improved Operation in Areas With High Radon Background Levels
- ◆ **High Volumetric Flow Yielding High Sensitivity**
  - Low Pressure Drop
  - Low Power Consumption
  - Low Noise Levels
- ◆ **Particle Size Distribution Capability**
- ◆ **Integrated Calibration**
- ◆ **Sample Archiving System**

# Comparison to Other Developing Technologies

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- ◆ **Under Development by DOE (at LANL)**
  - Called FTAM and LRAM (or LRAD)
  - They Also Avoid Need For Filtering
  - Only Measure Gross Alpha Contamination Levels
- ◆ **Neither is Suitable for CAM Use (Not Isotopic - No Radon Discrimination)**

# Other Performance Advantages

ThermoPower

- ◆ **Cost Reduction - In Both O&M Labor and Lost Work Time**
- ◆ **Schedule Acceleration - Better Control of Operations, Fewer False Alarms**
- ◆ **Reduced Public and Occupational Health Risks - Improved Radon Discrimination Yields Dose Reduction**
- ◆ **Reduced Environmental Impacts - Improved ALARA Operations**

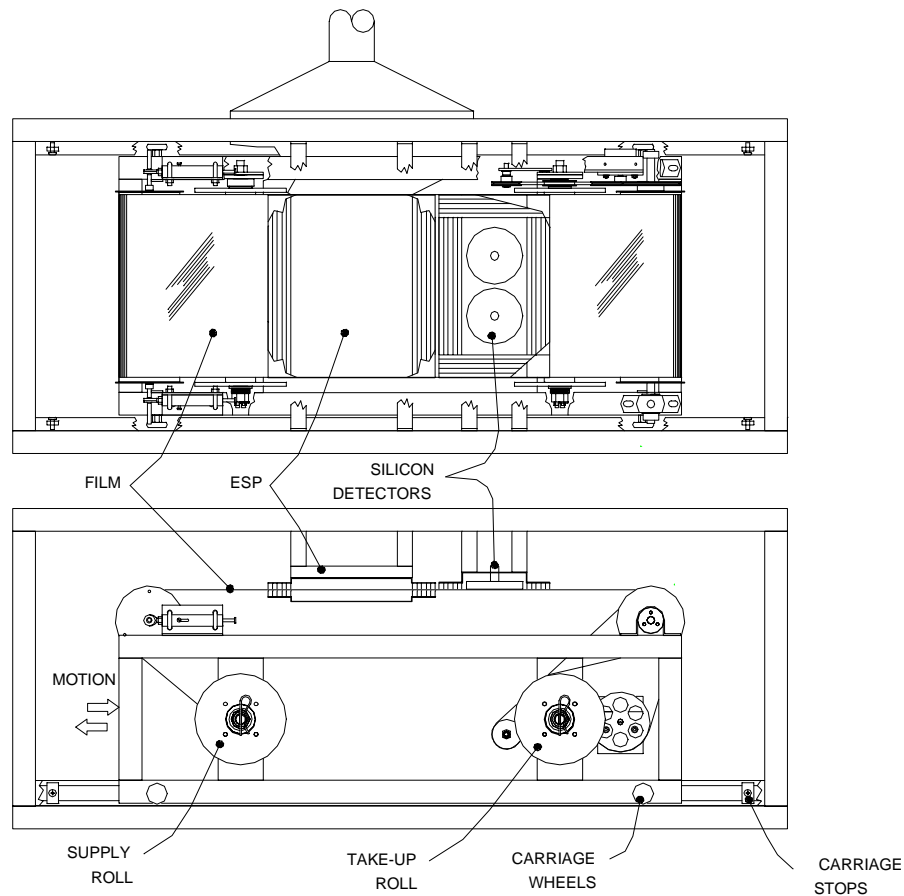
# Project Status

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- ◆ **Productive LRRI Kickoff Meeting**
  - Design Criteria - Archiving of Sample is Important
  - End User Input - AMUG, HPIC, HPS Annual Meeting
- ◆ **Design Criteria Complete**
  - Method of Enhancing CAM Response Time
  - Interest From LANL, WIPP, SRS, Hanford
- ◆ **Now - Building/Testing 2 Iterations of ESP-CAM**

# Current Design

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# Future Plans: Phase I

ThermoPower

- ◆ **Prototype Instrument**
  - Complete Startup and Testing
  - Determine Sensitivity and Radon Discrimination Attributes
- ◆ **Determine LSDDP Site for Phase II Field Test**
- ◆ **Continue Receiving Feedback from AMUG, HPIC and HPS End Users**
- ◆ **Phase I Ends Sept. 30, 1999**

# **Future Plans: Phase II**

**ThermoPower**

- ◆ **Provide Improved Phase II CAM Instrument**
  - For LRRI Benchmarking
  - For LSDDP Field Test
- ◆ **Conduct LRRI Tests and Field Test**
- ◆ **Continue Receiving Feedback from AMUG, HPIC and HPS End Users**
- ◆ **Phase II to Continue for 12 Months More**

# Summary

ThermoPower

## ◆ Water Alpha Monitor System

- Successfully Field Tested on Oak Ridge Reservation (ORR Y-12 Plant)
- Sensitivity 2000X Beyond EPA Limits
- Interest in Deployment at ORR and LANL

## ◆ Alpha Continuous Air Monitor System

- Proof of Concept in Lab
- Much DOE Interest (LANL, WIPP, SRS, Hanford) in Initial Results
- Phase I On Schedule